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SUBSTANTIVE THEME: WAYS AND MEANS OF ENSURING THE PARTICIPATION OF DEVELOPING COUNTRIES IN INTERNATIONAL COOPERATION FOR RESEARCH ON AND DEVELOPMENT OF ENVIRONMENTALLY SOUND TECHNOLOGIES, AND THE RAPID AND EFFECTIVE TRANSFER OF SUCH TECHNOLOGIES TO THE DEVELOPING COUNTRIES

Report of the Secretary-General

SUMMARY

The report stresses the role of technologies with regard to global environmental concerns. It supports a concept of environmentally sound technology as an integral part of a national policy for sustainable development.

The global dimension of current environmental challenges calls for concerted action. Industrialized and developing countries must agree on a means of fair cooperation to address the growing environmental crisis. International conventions on global environmental concerns are needed which reflect the involvement of developing countries as true partners in the major efforts required. The final implementation of the goals and targets of such conventions require the application of environmentally sound technologies, which are available in many areas but often not easily accessible to developing countries. As many technologies are costly, the demand arises for international cooperation to ensure that environmentally sound technologies will be accessible to developing countries, expeditiously, and on a fair and favourable basis.

* A/CN.11/1991/1.

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The needed assistance of industrialized countries and international organizations should be supplemented by efforts to enhance the endogenous capacities of developing countries in science and technology, by means that include different forms of research, as well as partnerships between public and private entities in industrialized and developing countries. This involves guidance in the capacity to make informed choices based on technology assessment, to apply and manage technologies, and to generate home-grown research and development capabilities.

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INTRODUCTION

1. At its tenth session in 1989, the Intergovernmental Committee on Science and Technology for Development decided to select for its eleventh session the substantive theme "Ways and means of ensuring the participation of developing countries in international cooperation for research on and development of environmentally sound technologies, and the rapid and effective transfer of such technologies to the developing countries". The Centre for Science and Technology for Development was requested to prepare a comprehensive and analytical report on the subject, in consultation with other United Nations bodies and international organs. The General Assembly, by resolution 44/14, endorsed the conclusions of the Intergovernmental Committee.

2. The concept of environmentally sound technology implies a new evaluation of the relationship between people and nature: a moving away from the domination of nature to working with nature, and reassessing the methods used for the transformation of natural resources into useful products. This calls for a combination of effective action regarding environment and development, taking into account the different relationships between social, economic, technological and environmental conditions and requirements at the national and international levels. The Declaration on International Economic Cooperation, in particular the Revitalization of Economic Growth and Development in Developing Countries, adopted by the General Assembly in its resolution S-18/3 of 1 May 1990, stresses, inter alia, the relationships between (a) poverty, demographic pressures, unsustainable production and consumption patterns and environmental degradation; (b) external indebtedness of developing countries and the phenomenon of net transfer of resources from developing to developed countries, and their ability to contribute fully and in accordance with their capacities and responsibilities to global efforts to preserve the environment; (c) international economic climate, including the need to reverse the terms of trade when those are unfavourable to developing countries, and the degradation of the environment; and (d) environment, development and market mechanisms.

3. However, the efforts of developing countries in the areas of family planning and mitigation of poverty are not likely to have any great effect in the near future. As developing countries struggle to meet the current needs and aspirations of their growing populations while facing the challenge to contribute to the preservation of the local and global environment, the development, transfer, application and management of environmentally sound technologies is playing an increasingly important role.

4. Environmentally sound technology is a relative concept in that it depends on the level of information and knowledge available and the perception among the different parties in a society participating in the development process (stakeholders). This implies the following: (a) that what might be perceived as environmentally sound today need not necessarily be sound tomorrow; and (b) that any technology must be viewed in relation to the socio-economic and cultural conditions in which it is operating, thereby creating an interaction whose outcome needs to be constantly assessed.

5. Technologies that can slow down or even reverse the trend of environmental degradation in the atmosphere, biosphere and geosphere without reducing or delaying economic growth are available in many areas. Advances in biotechnologies can benefit developing countries, particularly in the areas of food and agriculture as well as human and animal health care. Environmentally sound energy technologies are on the market which can be applied to meet growing energy needs, including those of rural areas. Progress has been made in the development of technological alternatives to chlorofluorocarbon-based technologies.

6. Nevertheless, the availability of environmentally sound technologies on the market is only one side of the coin. Developing countries may face serious problems in their ability to afford them. As such technologies are central to sustainable development, it is incumbent on the international community to find ways and means to promote the transfer of environmentally sound technologies to developing countries, including financial assistance to developing countries from funds additional to current flows.

7. Emphasis should be given to the fact that the generation of home-grown technologies, as well as the adaptation, application and proper management of transferred technologies, would require a "critical mass" of endogenous capacity in science and technology, including a minimum of research and technology assessment capabilities.

8. Consequently, in addressing the areas of principal action to be taken by the 1992 United Nations Conference on Environment and Development, the report of the Secretary-General of the Conference to its Preparatory Committee stressed, inter alia, the following: "Technology, particularly the need to make the most environmentally sound technologies universally available, is a major element in respect of many areas requiring action. Of special importance are measures required to make such technologies and the capacities to develop and apply them available to developing countries under conditions that are fair and affordable" (A/CONF.151/PC/5, para. 28 (e)).

I. CURRENT STATUS

A. Global environmental concerns

9. The world may be moving towards an environmental crisis that will seriously affect the development prospects of all countries. Climate change and global warming, depletion of the ozone layer and the loss of biodiversity have a particular effect on sustainable development resulting from the fact that (a) the damage that is being done to the environment is partly non-reversible; (b) major activities related to these issues in one country could affect the majority of all nations; (c) some of the remedies must be taken on a global scale; and (d) transfer of resources, financial and otherwise, to developing countries is essential to reach meaningful solutions.

10. Industrialized countries consume a disproportionate share of the world's natural resources and are responsible for generating the greatest volume of waste and emissions. Significant improvements in the global environmental situation

require radical changes in the production and consumption patterns of industrialized countries.

11. Nevertheless, in developing countries overexploitation of marginal lands, massive deforestation for farming, mining, lumber and fuel wood - often a result of the combination of poverty and population growth - as well as the application of environmentally "unsound" technologies and methods of cultivation, have also begun to affect the environment.

12. Deforestation accelerates land degradation processes and contributes to a diminishing of the natural cycle of carbon dioxide absorption. Rice paddies and domestic cattle, the basis of the food supply of more than 2 billion people in developing countries, are major sources of methane, another greenhouse gas. Extensive use of fertilizers and pesticides has negative consequences, not only for land and water resources but also for the health of farmers.

13. In addition to these developments, industrialization and urbanization in some developing countries are increasing the pressure on the natural resource base. Although developing countries as a whole are responsible for less than one quarter of all fossil-fuel-based carbon dioxide emissions, the demands of development, coupled with population growth and urban migration, have already increased the rate of growth of energy consumption in developing countries to levels higher than that in industrialized countries.

14. The environmental challenge requires an increased solidarity among all nations and the political will of all countries to search for a concept of sustainable development guided by the phrase "think globally, act locally".

B. International conventions

15. The global dimension of current environmental challenges calls for concerted action. International conventions on global environmental concerns are required which reflect the involvement of developing countries as true partners in the required major global efforts, and their cooperation in signing, ratifying and adhering to such conventions must be ensured.

16. The United Nations Conference on Environment and Development will reflect important progress that has been made at the international level to give effect to the concept of environmentally sound and sustainable development as it was articulated in the Report of the World Commission on Environment and Development: Our Common Future (the "Brundtland report"). 1/

17. Resolution 45/212 adopted by the General Assembly which, inter alia, refers to the work of the Intergovernmental Panel on Climate Change and the results achieved at international meetings on the subject, including the Second World Climate Conference, could be a starting point towards the negotiations leading to a framework convention on climate change. Such a convention would be drawn up in protocols and action plans containing mechanisms to implement specific targets and goals directed towards reducing emissions of carbon dioxide and other greenhouse gases.

18. A landmark agreement was reached through the adoption of the Montreal Protocol on Substances that Deplete the Ozone Layer. 2/ An Interim Multilateral Fund was established in 1990 for a period of three years, to assist developing countries in financing the incremental costs they will incur in complying with their obligations under the Protocol. The Fund will be additional to existing aid flows to developing countries. The assets of the Fund currently stand at $160 million, which soon will be increased to $240 million as additional developing countries sign the Protocol. 3/ This has been connected with the agreement on a mechanism to facilitate the transfer of non-chlorofluorocarbon-based technologies which are needed to halt further global damage and reverse the damage already caused to the ozone layer.

19. Based on the work of the Ad Hoc Working Group of Legal and Technical Experts on Biological Diversity which has been established to negotiate a Global Framework Convention on Biological Diversity, a Draft Convention on Biological Diversity has been prepared. Consultations have emphasized that the protection of the biosphere, especially in relation to biological diversity in the context of representative ecosystems, should be strongly related to the need of improving the social and economic situation of populations living in those ecosystems.

20. Climate change, ozone layer depletion and loss of biological diversity are global environmental issues that have a strong technological relevance. They are in the forefront of international deliberations preceding the 1992 United Nations Conference on Environment and Development. Without underestimating environmental concerns of a more local or regional character, and without denying their relevance to the overall environmental problem, there is some evidence that those concerns can be negotiated within action plans that could be identified as operational elements of global conventions and be implemented mainly on the basis of bilateral or regional projects and programmes.

21. International conventions and other legally binding agreements on global environmental concerns mostly identify goals. The question is how to achieve the particular targets within a certain time-frame. The answer is directly related to the responsibilities of countries in terms of their share in the degradation of the global environment as well as their capacity to engage actively in the process of implementing such international agreements.

22. Although negotiations on international conventions should be guided by the common responsibility of all countries, actions on the basis of an "equal percentage" strategy would not reflect the lower contribution of developing countries to global environmental degradation both in the past and in the present. Moreover, a uniform regulation of this type would be unrealistic in view of the very limited capacity of the majority of developing countries to allocate resources for preserving the global environment.

23. The industrialized countries possess the technologies as well as the financial and institutional means to monitor and mitigate environmental damage. They virtually dominate research and development of environmentally sound technologies; they also, in principle, control the transfer of such technologies to developing countries. Furthermore, the industrialized countries have the capacity to make

best use of those technologies according to their different needs. In contrast, developing countries are disadvantaged in most of the above-mentioned aspects.

24. Thus, targets for developing countries must be formulated on realistic terms of responsibility, affordability and capacity, thereby enabling developing countries to react to global environmental challenges without sacrificing their legitimate rights to economic growth.

C. Endogenous capacity-building

25. Given that the creation of national conditions for applying and managing of environmentally sound technologies in the productive sector is crucial to the efficient use of such technologies, special attention must be paid to building up endogenous capacity in science and technology. A "critical mass" of endogenous capacity is also a necessary prerequisite for generating home-grown technologies and increasing the share of developing countries in international cooperation for research and development of environmentally sound technologies.

26. The end-of-decade review of the implementation of the Vienna Programme of Action, conducted by the Intergovernmental Committee at its tenth session (A/CN.11/89), showed that:

(a) The building of endogenous capacity has yet to take deep roots in most developing countries;

(b) Future emphasis on the development of policies, infrastructures and human resources should be less on quantity and prestige but more on quality and socio-economic purpose with longer-term orientation;

(c) Drastic revision of current approaches to technical cooperation is needed with emphasis on well-conceived areas of priority attention evolved through national policy dialogues among stakeholders in the development process.

27. The efforts for building up endogenous capacities in science and technology over time, have led, in many developing countries to the creation of institutional structures for technology assessment, research and development, as well as for technological services. However, for a variety of reasons, the scientific and technological infrastructure and capabilities thus created have, in many cases, failed to fulfil their potential. This is partly due to the lack of necessary links (a) among the different elements of the scientific-technological infrastructure; (b) with the transfer of technology from abroad; and (c) with the national productive sector and its technology needs.

28. The efficiency of applied technologies depends, first and foremost, on the capacity to make appropriate choices based on technology assessment. This presupposes institutionalization of technology assessment and its networking with research institutions, technology centres and the productive sector. It also requires the elaboration of a methodology for technology assessment stressing the approach that technology is the connecting link in what might be called the

"technology-environment-development triangle". Such an approach should, however, be considered as a general guideline which may be specified on a country-by-country basis.

29. A necessary prerequisite for technology assessment to generate meaningful recommendations for technology choices is the availability of a reliable database as a source of information on available technologies, terms of transfer and ownership. Such a database is often not available in or accessible for developing countries.

30. Although reliable statistical data on research and development of environmentally sound technologies is not readily available, one can assume that the share of developing countries' investments in research on and development of environmentally sound technologies compared to industrialized countries is very small.

31. In global terms, the share of developing countries as a whole accounted for only 6 per cent of overall expenditures in research and development, of which around 80 per cent is undertaken in only about 20 countries. Most developing countries have been unable to mobilize even 0.5 per cent of their GNP towards research and development, in comparison to over 2.5 per cent in many industrialized countries.

32. With respect to human resources in developing countries, the density "index" for scientists and engineers engaged in research and development for every million inhabitants is estimated at 127 (49 in the case of Africa, excluding Arab countries) as against roughly 3,000 for the industrialized countries.

33. The gap between industrialized and developing countries in respect of technology generation, and the capacity to apply and properly manage technologies will likely increase because of the nature of environmentally sound technologies, which are mainly knowledge-intensive. They are characterized by a high degree of interdisciplinary scientific content and research intensity, high expenditure (both for research and production), intersectoral influences and a capability for horizontal diffusion, and rapid change and obsolescence.

D. Barriers to the transfer of technology

34. Environmentally sound technologies are available in many areas but not easily accessible to developing countries who often lack the financial means to cover, for instance, the demanding patent and licensing requirements. There are numerous other barriers which restrict the flow and increased use of environmentally sound technologies in developing countries.

35. An ongoing research study by the United Nations Centre on Transnational Corporations, on the transfer of environmentally sound technologies to developing countries under favourable terms, contains a provisional list of some of the barriers. The study divides the barriers into categories by actors. Each list then covers real or perceived barriers from the perspective of transnational corporations or developing countries.

36. Barriers from the perspective of transnational corporations, include:

(a) Reduced expectations of profits from sales of environmentally sound technologies due to lack of markets, legal requirements or market information;

(b) Difficulties in implementing high capital-intensive environmental protection technologies due to lack of adequate technical and/or social infrastructure;

(c) Unfair competition due to lack of comparable environmental regulations and standards in developing countries or internationally.

37. Barriers from the perspective of developing countries are:

(a) Patent holders prevent environmentally sound technologies from being used in developing countries by refusing to license the technologies or by setting costs too high;

(b) Developing countries are discouraged from using environmentally sound technologies because "polluting" technologies have a price advantage, current financial resources are insufficient to cover incremental costs and there are no new financial resources available specifically for environmentally sound technologies;

(c) Developing countries lack "eco-incentives" owing to limited information on local environmental problems and the existence of more pressing local priorities.

38. Most of the barriers listed are related to international trade and legal issues but they also emphasize the infrastructural changes necessary within developing countries for the successful transfer, maintenance and mastery of environmentally sound technologies. These changes, such as enhance local training, education, and research and development institutions in developing countries will require as much additional funding as the actual transfer of the technologies.

39. Given the current debt problems faced by developing countries, it is doubtful that those countries will be able to afford the costs normally incurred in transferring environmentally sound technologies, or accomplish the internal changes necessary for applying and managing those technologies, without the generation of additional external financial resources.

40. The relevance of intellectual property rights as legal instruments has been widely acknowledged for technology transfer and generation. National patent systems are key factors in protecting inventions. They significantly affect the transfer and application of environmentally sound technologies, many of which are new solutions to technical problems and industrial design.

41. In the international arena the Convention for the Protection of Intellectual Property, known as the Paris Convention, is strongly debated. Some developing countries contend that the Paris Convention favours the technologically advanced industrialized partners which, in principle, define the terms for transfer of patent rights, licensing and know-how agreements.

42. The requirement of "absolute novelty" in the granting of patents favours those cutting-edge and high-technologies that are usually produced in the industrialized countries. This has given the existing patent system a "high-tech bias". Simpler inventions - which could be the domain of developing countries - are further discouraged by the requirements of "inventive step" and "non-obviousness". The connection of patent protection with these strict requirements is seen as a discouragement of incremental technological changes that evolve organically out of the existing technological level.

43. Some developing countries have argued that the international patent system lacks transparency. Thus, it might be difficult, in particular for developing countries, to access typical patent information such as the state-of-the-art of a certain technology, detailed description of inventions, ownership or terms of transfer. To assist in more transparency, the World Intellectual Property Organization has created a State-of-the-Art Search Programme to provide, free of charge, institutions and individuals in developing countries with this type of information.

II. WAYS AND MEANS FOR PROMOTING INTERNATIONAL COOPERATION

44. The need for additional resources to implement the concept of sustainable development in developing countries calls for strong and continued assistance by industrialized countries and international organizations. Such assistance may support an increase in the local capability to make reasonable technology choices based on technology assessment and to generate home-grown research and development capabilities.

45. Technology transfer and endogenous capacity-building, including cooperation in research and development, are areas where the international community can contribute to promoting the concept of environmentally sound technology in developing countries. These areas are closely interrelated. In order to be successful in technology transfer, the conditions that (a) permit a recipient nation to make appropriate choices based on the assessment of available technology, (b) ensure the access to and affordability of environmentally sound technology, and (c) enable the recipient country to manage the technology and its future development, must be adequately addressed.

A. Transfer of environmentally sound technologies to developing countries

46. Proprietary technology is mostly in the hands of private entities. Therefore, technology transfer in the area of environmentally sound technology requires the application of mechanisms which permit publicly-funded intermediary institutions to purchase licences from private owners on a selective basis and make them available (with relevant support services) to public and private institutions in developing countries. The criterion for free licensing to the institutions should be the level of environmental benefit provided as compared with alternatives.

47. Proprietary technology exists in some areas which is often no longer used in the developed world but which could provide substantial environmental benefits for developing countries. By way of example, coal-burning technology for residential heating, which has been out of use in most developed countries, but could be applied for a certain period of time in developing countries with abundant coal supplies. There is a need to identify such technologies and to provide incentives for their marketing and further development through partnerships between the owner of the technology and the potential user in developing countries. Intermediary institutions mentioned above could serve as broker for this purpose.

48. Global environmental investment in developing countries may often produce greater overall benefits for the environment than investment within industrialized countries themselves. For example, some industrialized countries have financed programmes for tree planting in developing countries to compensate for the gases emitted by industrial plants in those industrialized countries. There should also be a focus on energy savings where the growth of consumption is highest and the efficiency of energy production is lowest. This consideration may lead to a special effort to bring clean technologies to developing countries in preference to sometimes more expensive marginal technological improvements in industrialized countries themselves.

49. Methods should be sought to stimulate investment by industrialized countries in cleaner technologies and more efficient energy generation and use in developing countries. For example, in areas of the world where carbon taxes have been established, such taxes should be used primarily to invest in the best carbon dioxide reduction projects on a global scale. A system of "carbon dioxide reduction credit" could be considered to encourage measures in this direction.

50. Much of the international discussion focuses on proprietary and commercialized technologies. But it should not be overlooked that although a large percentage of environmentally sound technologies are in the public domain, developing countries still face difficulties in gaining access to proprietary technologies. In this context, special attention should be paid to the transfer of technologies that are financed on a public basis or financed through mechanisms under public control. This applies to all technologies financed under terms of bilateral and multilateral development cooperation.

B. Funding mechanisms

51. Estimates have been made of the magnitude of the overall costs involved and the costs for developing countries to comply with the goals and targets of international agreements on global environmental issues. The World Resources Institute estimates that $26 to 65 billion would be needed to counteract the greenhouse effect. Another $2 to 7 billion would be required for the overall implementation of the goals and targets of the Montreal Protocol. 4/

52. According to an estimate published in a study by the United Nations Environment Programme, developing countries would need $1.8 billion over the next eight years to substitute the use of chlorofluorocarbons in industry by less polluting alternatives. 5/

53. The overall financial needs for biological diversity have been notoriously difficult to evaluate. The cost of conservation has been estimated by the United Nations Development Programme and the World Resources Institute in their report on the International Conservation Financing Project to be roughly $20 to 50 billion a year for the next decade.

54. Although the different estimates might be considered as rough calculations, showing considerable gaps with regard to their lower and upper levels, they all reflect the tremendous magnitude of funds required. Taking into account the debt situation of developing countries in the context of their primary target, which is to meet the basic needs of their populations, it becomes obvious that the funds required to cope with global environmental problems cannot be raised through traditional development assistance, grants or donations. Additional external funds must be mobilized to bridge the gap between what is available and what is needed, and appropriate mechanisms identified to manage those funds. Moreover, the long-term nature and magnitude of the problem is such that financial resources will be needed that are not only additional but also, as far as possible, sustained, predictable and assured.

55. Particular attention should be paid to incentive-based funding schemes such as market mechanisms, tradeable permits and consumption rights, taxation mechanisms, insurance and reinsurance, and offsets. The particularly attractive aspect of those innovative mechanisms is that they generally do not involve financial outlays of public funds from industrialized countries, nor the transfer of unusually large cash flows across international boundaries. Thus, such mechanisms generate resources additional to development assistance funding.

56. The effectiveness of incentive-based approaches to environmental protection depends widely on features that generally characterize smoothly functioning markets in a climate of abundant information flows. However, they can offer several potential advantages, such as self-financing, a better reflection of true costs of economic activities to society and, above all, stimulation of the development and application of cleaner technological solutions.

57. Market mechanisms include a variety of mechanisms such as rents, royalties, greenhouse investment funds, venture capital, joint industrial projects, eco-bonds, and green labelling that stimulate the market to behave in an environmentally friendly manner.

58. Tradeable permits and consumption rights such as the proposed international tradeable carbon emission permits, could generate financing for developing countries from the trading of under-utilized rights and the penalties imposed for infringements.

59. Taxation mechanisms could be applied to stimulate market behaviour that promotes penetration of environmentally sound technologies through user and producer taxes (example, fuel taxes) environmental fines, and incentives such as tax rebates, tax reductions, tax exemptions and subsidies.

60. Insurance and reinsurance can be geared to promoting an environmentally sound approach to economic activity through the transfer of knowledge related to the minimization of risks to insurers and the insured.

61. Offsets can be effected through the large-scale purchase of goods and services, such as through government procurement, as a way of generating resources to deal with environmental issues. They provide an incentive to the owners of technology processes, cheaper financing, distributions networks, access to information, and management skills to extend or develop their assets to support the environment.

62. The establishment of multilateral funds, such as international environmental funds, as exemplified by the Global Environmental Facility of the World Bank, UNDP and UNEP, constitutes clear evidence of the political commitment to move onto the environmental agenda. Such funds can play an important role in regulating the environmental balance between nations based on criteria of equity and international justice. They can also directly contribute to transferring environmentally sound technologies to developing countries and the strengthening of endogenous capacities in those countries.

63. Recent initiatives taken by some Governments of industrialized countries to link debt reduction to sustainable development in developing countries, have led to the use of debt conversion schemes. The most widely used type has so far been the debt-for-equity swap, mainly for industrial and tourism projects, but there is much more scope for development of a variation of these techniques - the debt-for-nature or debt-for-environment swap. A wide range of projects could be financed using those techniques, ranging from conservation and sustainable development of existing natural resources (for example, wildlife parks, botanical gardens, forestry management and soil stabilization) to new projects involving the application of environmentally sound technologies (for example, waste management, halting deforestation and promoting afforestation, sustainable agricultural development, pollution control and alternative energy sources), as well as the financing of education and research centres.

64. To avoid inflationary effects through the "unplanned" release of local currency into the economy, such programmes and projects should be limited in scope and only form part of an overall "menu" of funding mechanisms. It must also be stressed that debt conversion schemes will have to include not only nature preservation but also activities that directly address society's immediate social and economic needs. Therefore, swap programmes must be implemented with the agreement and under a certain control of the Government. Moreover, the participation of a well-established and competent domestic non-governmental organization to manage the endowment and conditions of such a programme will enhance its successful implementation.

C. Partnerships in research and development

65. In order to increase the share of developing countries in international research and development of environmentally sound technologies, different forms of partnerships should be used in private and public sectors and between them. Such

partnerships would allow for better utilization of know-how and other resources existing in universities, government laboratories and public service institutions.

66. The promotion of partnerships in research and development should be geared to development rather than market strategies. This, of course, does not exclude the need to target such partnerships towards commercialization of the research results.

67. Multilateral cooperation should be encouraged because it has the advantage that international solidarity aspects come into play, bringing the weaker and poorer partner into contact with the international scientific and technological community. The growing environmental crisis, which obliges each country to enhance its capacity for generating, applying and managing technologies, demands an increase in multilateral cooperation.

68. One approach to such collaboration could take the form of a network of international research centres. Some developed and developing countries are encouraging this approach. The network would be based primarily on existing regional research, development and demonstration centres, which must be strengthened, thereby linking these regional centres to national institutions.

69. The operational agenda of the regional centres should include both region-specific problems and universal or global problems, with emphasis on technical support for regional initiatives.

70. It is important that there should be some rationale for a division of labour between different institutes in different regions and a coherent programme for the allocation of resources among them, by which the institutes present their accomplishments and plans, and donors pledge their support according to their interests and the evaluation and recommendations of a technical advisory committee.

71. As in the centres of the Consultative Group on International Agricultural Research (CGIAR), the functions should include both research and extension with particular emphasis on demonstration. The extension/demonstration function may be partly carried out through local organizations and partnerships of various kinds, paralleling the important function of national agricultural laboratories in relation to the CGIAR system.

72. The regional institutes should serve as laboratories and/or field stations, not just information centres or think tanks. In the present state of communication, information on available technologies and environmental and health data are better circulated through networks, although the institutes might also serve a secondary function as nodes in this network.

73. Ultimately, the regional institutes should aim to be staffed mainly by scientists from the region, but also incorporate international scientists in order to bring a global perspective into play and help to build endogenous capacity through close collaboration between locals and expatriates in all aspects of the operation.

74. Scientists from developing countries might gain valuable experience from participating in the design and operation of a global observation and monitoring system and in research on global environmental change, including climate change, ozone layer depletion and loss of biological diversity, and their effects on development. The involvement of developing countries' scientists in the Global Change Research Programme is an important vehicle for linking science in the developing countries with the world scientific community, thereby contributing to the building of endogenous capacities in the participating developing countries.

III. POLICY ISSUES AND OPTIONS

75. Global environmental concerns such as climate change, ozone layer depletion and loss of biological diversity require global solutions which must be negotiated collectively, but local responses may be different. Policy decision-making should bear in mind that each country must interpret its environmental concerns as part of the global environmental situation, seek national solutions with the support of international cooperation, and identify the technologies most appropriate to implement those solutions. The final objective of technology application must be to achieve a given increment of development with a minimum global adverse environmental effect.

76. In the case of ozone layer depletion, substitutes for chlorofluorocarbons will primarily be developed in developed countries. Developing countries will benefit from the application of such substitutes in refrigerators, air-conditioners and in foam expansion.

77. In the case of carbon dioxide emissions, one should aim at the largest emission reduction for a given investment, regardless of location. This may often be in developing countries where energy production and consumption are less efficient. Thus, improvement of local technologies, such as in combustion efficiency, might have higher priority than further improvements in the energy efficiency of developed countries. Attention could also be given to local possibilities such as hydroelectric power or solar energy if they promise to be economically practicable in the near term.

78. The issue of "loss of biological diversity" differs widely from both of the above-mentioned environmental issues in terms of the role of technology. In this case, there is no clearly identifiable "pollutant" such as carbon dioxide or chlorofluorocarbons. Remedial actions are much more socially based and oriented. Biotechnology can assist the conservation of genetic resources and evaluation of germ-plasm for specific traits. Further international efforts should be made to establish gene banks and to associate them, where possible, with propagation facilities in developing countries.

79. Developing countries currently meet most of their technological needs by importing technologies which have been developed to meet the demands and conditions of industrialized countries. The effects of this massive transfer of technology on developing countries are ambivalent.

80. Governmental strategies and policies for the transfer of environmentally sound technologies would have to address the issue of interfacing this transfer with domestic technological innovation processes. A shift of emphasis from costs, terms and conditions of transfer towards establishing links between research and development, institutions and the acquisition of technologies transferred from abroad, is required. In this way the two streams of technology, those transferred from abroad and those generated within the country, are made to interact at the enterprise level and thus contribute best to a country's development objectives.

81. The transfer of environmentally sound technologies to developing countries should be combined with programmes which ensure the rapid diffusion of such technologies and thus effect the environment in a reasonable length of time. Consequently, mobile demonstration units may be used, in particular in rural and remote areas, to demonstrate the benefits of using such technologies and to convince rural residents to apply them. An example in this direction would be the use of efficient wood or charcoal burning stoves.

82. It is evident that, in many cases, environmentally sound technologies will be more costly than conventional technologies. This creates a need for generating additional funds and making them available for developing countries. Taking into account that least developed countries are heavily dependent on financing of development instruments under arrangements of development cooperation - private capital flows through investments and commercial financing have become rather marginal - the transfer of technologies to those countries, including the choice of technologies, becomes very much a matter of public concern.

83. This also applies to other groups of developing countries, especially those which are heavily indebted, have difficulties in gaining access to capital markets on competitive lending terms, but also those which are very dependent on the financing of their development activities through multinational development banks. In fact, this applies very much to the majority of sub-Saharan countries. In the light of this situation, the choice between the financing of projects which, in their design, still reflect conventional technologies and those which introduce alternative environmentally sound or less harmful technologies, is very much a decision to be taken by Governments which, on one side, constitute the boards of governors and directors of multinational development banks and, on the other side, the Governments of the borrowing countries.

84. Alternative technologies are normally not yet well introduced, or even fully known. This might suggest the establishing of a clearing-house for such alternative technolcgies, and encouraging engineering consultants who play a crucial role in the preparation and the design of projects to make the optimum use of alternative technologies.

85. This, of course, will not solve the problem of additional costs that arise in appraising the financial feasibility and economic practicability under the conventional practice of cost-benefit analysis and accounting, which raises the question of who should pay for those additional costs. It is proposed that projects continue to be appraised on the normally lower basis of the conventional technology, even if the mere costly environmentally sound alternative technology is applied. With regard to the additional costs, there should be an understanding

that these costs should not be an undue burden on the recipient country. There is a need for a special mechanism which would have elements of a fund and/or of a system of most favourable lending terms to finance those costs by the borrower.

86. Industrialized and developing countries should identify and take effective measures to remove barriers to the transfer and dissemination of environmentally sound technologies. "To this end, there is a need to transfer the best available environmentally sound technologies to developing countries expeditiously on a fair and most favourable basis". 6/

87. In this regard, international legal measures affecting technology transfer from abroad should be considered. Agreements on a Code of Conduct on Transnational Corporations and a Code of Conduct on the Transfer of Technology are important goals for all countries.

88. Such regulations could be also used as a legal basis to avoid negative developments in technology transfer such as the transfer of technologies that are banned in industrialized countries because of their environmentally "unsound" effects.

89. Triggered by the debate on the shortcomings of the existing patent system several proposals have been put forward. Among them has been the concept of establishing a new patent system which runs parallel to the existing one but leaves its operations unaffected. The additional patent system would cover property rights in cases that could not meet the stringent criteria of the existing patent system, but which would be relevant, particularly for developing countries, in putting new products on the market.

90. Considerable scope exists for establishing and strengthening different forms of cooperation and partnerships in research, development and application of environmentally sound technologies, between industrialized and developing countries at bilateral and multilateral levels. Programmes and projects carried out at the multilateral level should primarily tackle global issues as well as assist developing countries to strengthen technology assessment capacities and promote education. Bilateral efforts could be devoted to enhancing the innovation and management capacities of developing countries and should support those countries in basic and advanced training of skilled workers. Both bilateral and multilateral levels should be encouraged to utilize locally available personnel, know-how, infrastructure and technology.

91. Private/private as well as public/private partnerships could be of decisive importance to the industrial development and competitiveness of developing countries. They also would contribute to strengthening the national innovation potential of participating developing countries. Particular attention should be paid to promote the development and competitiveness of small and medium-sized enterprises in developing countries. For example, transnational corporations could commission small local firms for particular contracts relevant to environmentally sound technologies.

92. In partnerships where private entities are involved it is important that any legal regulations established for such cooperation should abide by governmental obligations to follow and audit the use of public funds. It is also important that such regulations respect the nature of private business. Research and development projects are of little interest for the private partner unless exclusive rights to the results can be guaranteed.

93. The establishment of intermediary, publicly-funded, institutions to provide technology brokerage services should be encouraged. Moreover, privately-funded intermediaries may find niches as well. For example, a consortium of firms might support intermediaries to manage the licensing of technologies to small markets where it may not be worth while for one firm to negotiate and supervise separate agreements for each market. Also, transfer of information and expertise of a non-proprietary nature on environmentally sound technologies might be accomplished in this way.

94. Basic and advanced training for skilled workers holds enormous potential for research and the acquisition of technical know-how. It supports the build-up of the "critical mass" in science and technology necessary to generate, apply and adapt technologies. In partnerships where the private sector is involved, particular attention should be paid to supporting developing countries in building a stock of engineers who can serve as link between technical know-how and its incorporation into the productive process. From the point of view of development policy, training which takes place in developing countries should have priority. For Governments of developing countries it is important to create performance-related incentives for skilled workers and to improve the conditions for scientific research and technological development in their countries.

95. Collaborative activities are often substantively hampered by a lack of reliable data on ongoing efforts, their relative size, their nature and objectives, the participants and the state of implementation. Provision of an adequate data bank and access to this information in relation to programmes and projects at bilateral as well as multilateral levels should be given high attention.

96. International cooperation in research and development of environmentally sound technologies which address the global environmental challenge calls for creative measures to generate know-how and technologies at the multilateral level. In that context, the international community should explore the potential value and practicability of establishing a world-wide network of international research centres as a consultative group on international research on environmentally sound technologies. Such a network would concentrate on the technological and information demands emerging from international conventions on global environmental concerns.

97. Given the rapid pace of technological advancement and related structural change in the world economy, which significantly affects the trade and development structures and operational abilities of weak economies, it may be worth while to explore the extent to which suitable technological cooperation between developing countries could enhance structural and technological change in developing countries' economies.

98. The new development concept emphasizes participatory decision-making in all societies. Sustainability of development requires continuity and resiliency of policies. Consensus-building between Governments and the private sector and community participation at the local and national levels is needed in the decision-making process related to technology choices. Existing institutional structures should therefore be adapted as necessary to meet new and emerging requirements.

99. Governments should establish policy instruments to encourage enterprises in both the public and the private sectors to participate in integrating and adapting to global and local environmental concerns, especially if current regulations and market rules do not sufficiently consider the internalization of environmental costs. Such costs may also not be adequately included in the calculations of enterprises, partly because of lack of knowledge of the environmental effects of production processes and products and the social costs needed to clean up those effects.

100. Such instruments that Governments could consider include (a) fiscal incentives such as fees, taxation and subsidies; (b) information support, such as advertising, education and training, and notification of changes in laws and regulations; (c) research, development and demonstration assistance to establish and manage response strategies; and (d) environmental legislation for pollution control and setting of environmental standards.

101. Fiscal incentives should be designed to internalize environmental costs, thereby altering the market prices of products and equipment to fully reflect social costs of environmental pollution.

102. Information support could be used by Governments to increase the ability of decision makers at the enterprise level to make qualified technology choices, in particular with view to broader and long-term development objectives.

103. Research, development and demonstration assistance may be used by Governments to accelerate the process of technological change through the promotion of invention, innovation and diffusion. A major goal of such assistance should be to reduce risks and uncertainties to the effective application of those technologies, including the elaboration of "hedging strategies". At the invention stage, the defining of property rights and issuing of inventor's certificates are important; at the innovation and diffusion stages, market information is important.

104. Environmental regulations which have the force of law should support the consideration of the principles of "pollution prevention" and "the pollutor pays" in economic decisions and activities.

105. The reversal of the environmental degradation at national, regional and global levels will only succeed with a gradual shift towards a more socially sustained development. This requires a breakthrough in the concepts of development and international cooperation, and a departure from "business as usual".

106. However, international cooperation cannot replace the political will and concerted action needed to effectively implement the concept of endogenous capacity in science and technology as the decisive prerequisite in the management of technological change towards sustainable development. The potential for environmentally sound technologies to respond effectively to global and local environmental concerns in developing countries will remain limited unless that capacity is built up.

Notes

1/ World Commission on Environment and Development. Our Common Future (Oxford University Press, 1987).

2/ Final Act of the Conference of Plenipotentiaries on the Protocol on Chlorofluorocarbons to the Vienna Convention for the Protection of the Ozone Layer, convened by the United Nations Environment Programme, Montreal, 14-16 September 1987.

3/ D. Jane Pratt, "Funding of the global environment", paper presented at the first session of the Preparatory Committee for the United Nations Conference on Environment and Development, Nairobi, August 1990.

4/ Mohamed T. El-Ashry, "The transition to sustainable development: the United Nations 1992 Conference and beyond", paper presented at the meeting of Senior United Nations Officials for Social and Economic Development, New York, 25 January 1991.

5/ "The costs to developing countries of entering the Montreal Protocol", study presented at informal consultations on financial mechanisms organized by the United Nations Environment Programme (UNEP/OL.Fin.1/Inf.2 of 18 January 1990), p. 43.

6/ Ministerial Declaration of the Second World Climate Conference, Geneva, 29 October-7 November 1990 (A/45/696/Add.1, annex III), p. 2.

Annex

BACKGROUND

1. In addition to the present report of the Secretary-General, the Centre for Science and Technology for Development has prepared a background document entitled "Environmentally sound technology assessment (ESTA)". This exercise responds to the request of the General Assembly in its resolution 44/14 that the Centre, in cooperation with other United Nations bodies, should serve as the focal point for technology assessment within the United Nations system. The document will be distributed to the Intergovernmental Committee at its eleventh session and subsequently will be published as issue 7 of the Advanced Technology Assessment (ATAS) Bulletin.

2. A preliminary outline of the background document was before the United Nations Advisory Committee on Science and Technology for Development at its tenth session in April 1990 and the Task Force on Science and Technology for Development of the United Nations Administrative Committee on Coordination at its eleventh session in May 1990. A revised version was discussed with members of the Intergovernmental Committee, the Bureau of the Advisory Committee and selected experts at a meeting in November 1990. Drafts of the Secretary-General's report and the background document were again considered by the Advisory Committee at its eleventh session in January 1991 and by the Task Force at its twelfth session in February 1991.

3. The Centre requested national science and technology focal points and regional bodies of Member States to provide information on the generation, transfer, assessment, application and management of environmentally sound technologies. Detailed material addressing specific issues and aspects related to the topic and reflecting national experience in varying country situations has been provided by both developing and industrialized countries.

4. Such activities ensure the active participation of the Intergovernmental Committee in preparations for the 1992 United Nations Conference on Environment and Development.